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**Modular Housing Development in Boston:
An Affordable Housing Option Revisited**

by

Ketsia Colinet

Bachelor of Architecture
Illinois Institute of Technology, 1995

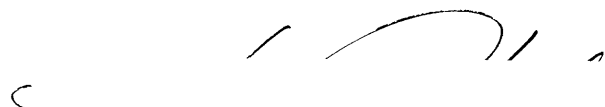
Submitted to the Department of
Urban Studies and Planning in Partial Fulfillment of
the Requirements for the Degree of

Master in City Planning
at the
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June 1998

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Abstract

This thesis discusses the use of modular housing in providing low cost housing. Modular building technology is often considered an option in developing affordable housing with the assumption that automatic savings can be realized. Although cost savings can be realized by this method of housing development, one must understand and properly utilize the efficiencies of the modular production process.

This thesis focuses on how Codman Square NDC (NDC), a local community development corporation in Boston, will use modular housing to develop 50 units of affordable housing. A case study will be presented which analyzes the NDC's application of modular building technology in its housing development plans. I conclude that the NDC has not fully utilized the efficiencies of the modular production process and therefore the organization will not realize the optimal savings that modular housing has to offer.

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Acknowledgments

Giving honor to God, who is the head of my life, for whom the completion of this project was made possible.

I am sincerely grateful to the following individuals who provided assistance in this research.

First, I would like to thank my thesis committee, Lang Keyes and Phil Clay, who were always with helpful. Their patience and support guided me through the process of structuring and writing this thesis.

I became aware of the subject of modular housing through Ann Houston at Codman Square NDC. For two years, I worked with Ann as an intern with the NDC. My internship experience with this organization has been an important part of my education at MIT.

I am thankful to the interviewees who were unselfish with their time and were willing to share their experiences and insight on modular housing. These individuals include Mossiak Hacoban at Urban Edge; Bill Jones, former Executive Director of Codman Square NDC; Sister Margaret Leonard at Project Hope; and John Sharratt at John Sharratt Associates.

Finally, I would like to thank my parents Josette Colinet and Adarad Colinet and my Godfather, Theron Holiday for their love and encouragement throughout the years.

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INTRODUCTION

As the construction costs for developing affordable housing continues to increase, federal subsidies which aid in lowering this cost have continued to decrease. In the interest of maximizing the use of limited federal resources, affordable housing developers are seeking to use more efficient methods of construction to provide low cost quality housing. Modular housing is one development option that is under consideration.

While there are several advantages to its use, including its faster turnaround time, high quality of the product, and its efficiency in mass-producing housing, modular building technology is primarily used with the intention of lowering the development cost of housing. In comparison to conventional stick-built housing, modular housing is promoted as having the potential to offer a 10-20% savings in cost while offering a comparable product. Once again, it is important to note that modular housing has the *potential* to offer savings. The potential savings can be realized only if the developer properly understands and fully utilizes the efficiencies that the modular production process has to offer. Therefore, the developer must determine under what circumstances can the potential savings be realized and if the circumstances and savings are reasonable to proceed with development.

Codman Square Neighborhood Development Corporation (NDC), a non-profit community development corporation in Boston, is pursuing a housing initiative to use modular building technology to develop 50 units of affordable housing in its service area.

The NDC has chosen this development option with the intention of recognizing a significant savings in the cost of developing this project. As previously stated, the savings that modular housing has the potential to offer can only be recognized if the developer properly understands and fully utilizes the efficiencies of the modular production process.

The purpose of this thesis is to assess whether Codman Square NDC understands and utilizes the efficiencies of modular housing in order to recognize the optimal savings that this development alternative has to offer. The experiences of the NDC, as recorded in this thesis, may serve as a valuable lesson for other CDCs in Boston contemplating the use of modular building technology to develop affordable housing.

In addition to focusing on the NDC's use of modular building technology, the thesis provides the reader with information about the modular housing industry and its use in developing low cost housing. The following paragraphs provide an outline and brief highlight of the discussion topics in this thesis.

Chapter One establishes a definition of modular housing and discusses the advantages and disadvantages of its use. Chapter Two provides a historical overview of the modular housing industry and a historic overview of modular housing in Boston by looking at Boston's experience in developing modular housing. Chapter Three discusses the institutional barriers to developing modular housing and how these barriers impacted, if at all, the City of Boston in its previous experience in developing modular housing. Chapter Four lays out the elements of cost savings that modular housing offers.

Chapter Five is a case study of modular housing and the Codman Square NDC. This chapter focuses on the NDC's previous experience in using modular building technology to develop affordable housing and also analyzes the present trade-offs the NDC will make in its pursuit to develop modular homes. The conclusion synthesizes the findings and makes an assessment of the NDC's use of modular housing to determine how well it has utilized the efficiencies of this process of developing housing.

CHAPTER ONE

Modular Housing: A Definition

Modular Housing vs. Manufactured Housing

In the course of this research I encountered variations in the way ‘modular’ housing is defined. Some authors that have conducted extensive research on the modular industry have acknowledged inconsistencies in the use of the term, which dates back to the industry’s emergence in the 1950’s. The inconsistency in terminology most frequently occurs in the definition of modular housing in relation to manufactured housing.

In several sources, manufactured housing is used as an umbrella term to describe all housing types that are partially or completely developed in factory rather than on the site. Under this definition modular housing would be classified as a manufactured home.

The definition I will use to make the distinction between a manufactured and modular home is as follows:

A manufactured home is a structure, transportable in one or more sections, which...is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes plumbing, heating, air conditioning, and electrical systems contained therein.¹

A modular home consists of one or more three-dimensional modules that are 80 to 95 percent factory produced and finished. The modules are shipped from the factory and

¹ Diane R. Suchman, *Manufactured Housing: An Affordable Alternative*, ULI Research Working Paper Series, March 1995, p. 1. Paper 640.

towed on a flat bed trailer to the building site where they are placed on a prepared permanent foundation.² In some cases the extent of interior finishing for a modular unit includes electrical wiring, plumbing, decorating, carpeting, and affixed appliances.

Two primary elements that distinguish manufactured and modular homes are the building compliance codes by which the units are constructed and the use of a permanent chassis in manufactured homes. Manufactured homes are built according to the construction and safety standards of the Department of Housing and Urban Development (HUD) using the HUD Code, while modular homes are constructed according to local state building codes and regulations which are either BOCA (Building Officials Conference of America) or UBC (Uniform Building Code). Unlike modules, manufactured homes require that the chassis used for transporting the unit to the site remain a permanent structural component of the home.

² James Carper and the National Association of Home Builders, *Using Building Systems: Modular, Panelized, Log, Dome*, Washington D.C., the National Association of Home Builders and the United States, 1990, p. 5.

The Advantages and Disadvantages of Modular Housing

In comparison to the conventional stick-built home, modular housing is presented as offering the following potential advantages that result in a saving in the cost of developing a home:

- *The factory production process allows for greater efficiency in developing housing units in volume.*

The standardized manufacturing process allows for mass production of housing with fewer mistakes and less waste of material which results in a lower square footage cost for a housing unit. The efficiency of the production process means greater worker productivity, and less loss of time due to inclement weather conditions. Housing production can also occur year-round.

- *The factory production process allows for a faster turn-around of a nearly complete housing unit.*

Modular units can be developed and ready for habitation in nearly half of the amount of time as the conventional stick-built home. The faster turn-around time results in a lower construction financing cost.

- *The factory production process allows for greater quality control and the possibility of a consistently higher quality product.*

The controlled environment of the factory allows for modular units to be protected from the elements of nature during the construction process. The quality of the construction and assembly process is continuously inspected as the module moves along the production line. Modular homes are developed to high standards of quality as the units are overbuilt to withstand the stresses of factory handling, highway transportation, and site erection.

- *The factory production process offers a reduced cost in labor.*

By the nature of the production process, a fewer number low skilled non-unionized laborers are needed to construct and assemble a housing unit.

Laborers are trained to concentrate exclusively on a particular specialty.

The advantages of modular housing should be assessed against the potential disadvantages, which include the following:

- *Modular housing development may be prevented in cities with strong organized labor unions.*
- *Modular units may be damaged during transportation from factory to site or in the process of placing a unit on its foundation.*
- *Once the manufacturing process has begun it is difficult to make design changes to a unit.*
- *Shipping costs represents an additional and sometimes significant cost element in modular housing.*

While shipping costs are incurred in conventional construction, as materials are transported to the development site, this is usually a greater cost in modular housing.

The strongest potential disadvantage to modular housing is the prevention of development by organized labor. However, if labor unions are not a factor, the advantages to using modular housing outweigh the possible disadvantages. The benefits of this method of housing production have the capacity to add savings in cost while offering a product of high quality.

CHAPTER TWO

Historical Context of the Modular Housing Industry

The provision of a “decent home and a suitable living environment for every American family” has been the purported goal of the United States government since 1949. The post war period marked the era in which the Federal Government made national recognition of fact that a housing crisis existed within the midst of America’s cities. Families of low and moderate income were specifically impacted, there were stark inefficiencies in the supply of affordable housing. With the enactment of the Housing Act of 1949, the Federal Government set out to significantly increase the availability of affordable housing. Unfortunately, this Act was not successful, as many low and moderate-income families did not benefit from the limited supply it provided. While housing acts were enacted thereafter to address the issue of inadequate supply of affordable housing, the Housing Act of 1968 was instrumental in specifically focusing on this issue through research on alternative cost efficient methods of housing development.

As urban centers faced heightened levels of poverty, physical blight, and crowded and substandard housing, several pieces of housing legislation were enacted between 1950 and 1966 to increase the supply of decent affordable housing. Unfortunately, these programs fell short of their proposed objectives. By 1967, President Lyndon B. Johnson reaffirmed the urgency of generating “ideas and instruments for a revolutionary improvement in the quality of life in the American city,” and appointed the National

Commission on Urban Problems.³ Based on the comprehensive research of the Commission, Congress enacted the Housing Act of 1968 and appropriated funds to carry out the final recommendations of the Commission.

At the time, the Housing Act of 1968 was regarded as the “most decisive advance” for achieving an increased supply of housing particularly for low and moderate-income families.⁴ The goal of the Act was to develop 26 million units of housing between 1969 and 1978. Unlike previous federal housing efforts, the Housing Act of 1968 set out to increase the supply of affordable housing by incorporating innovative methods of housing production. Through that Act the federal government encouraged the infusion of modern technology within the building industry, which allowed for the development of the modular housing industry.

In 1969, the Department of Housing and Urban Development’s Secretary George Romney introduced Operation Breakthrough as part of HUD’s effort to stimulate the public and private housing market to make use of innovative methods of housing production. Secretary Romney viewed Operation Breakthrough as a mechanism to ‘breakthrough’ the barriers of financing, labor, material shortages and codes that he believed were limiting production and affordability of housing.⁵

³ Nathaniel Keith, *Housing America’s Low and Moderate-Income Families: Prospects and Problems Under Past Programs, Prospects Under Federal Act of 1968*, Prepared for the Consideration of The National Commission on Urban Problems, September 1968, p.iii. Research Paper No. 7.

⁴ *ibid.*,

⁵ James Carper and the National Association of Home Builders, *Using Building Systems: Modular, Panelized, Log, Dome*, Washington D.C., the National Association of Home Builders and the United States, 1990, p.11.

Operation Breakthrough was essentially a research program that allowed developers to test and demonstrate their housing production systems while having all startup costs underwritten by HUD. The objective of Operation Breakthrough was to further develop the technological processes of industrialized housing. Results from this initiative were to be instrumental in guiding future development processes for increasing the supply of housing by mass production at a high volume and at an inexpensive cost. In June of 1969, HUD issued Request for Proposals to participate in the program. A total of 236 companies submitted responses to the proposal and 22 winners were selected.

One of the industrialized housing methods analyzed in the Operation Breakthrough program was modular housing. The factors that contributed to the growing interest in the modular housing industry were its low cost of labor, higher quality control of the product, rapid turn-around time which resulted in lower construction financing costs, and its overall production efficiency. General market economic conditions that affected the potential earnings of the construction industry during the early 1970's also added to the interest of the modular housing industry:

The relative trends of inflation and productivity over the past five years have also played an important role in the formation of the modular housing industry. If it had not been for run-away inflation in the construction industry, the pressures leading to the modular housing industry may not have been so great. The wage rates for skilled labor in the building trades have risen much more rapidly over the past five years than for unskilled factory labor. At the same time, the productivity in on-site construction has lagged behind that which is available through factory operations. Therefore, the economic climate was

favorable to the emergence of modular housing, since the concept of factory production offered an answer to the twin problems of rising costs and lagging productivity.⁶

While initially the potential success of Operation Breakthrough was viewed with great optimism, its actual accomplishments and existence were short-lived. The program was planned for implementation in three phases: Phase I, Design and Development; Phase II, Prototype Completion; and Phase III, Volume Production. Only 14 of the 22 original program participants built Phase III projects, which resulted in 1500 housing units being developed out of the 2800 that were initially planned.

Much of the limited success of Operation Breakthrough can be attributed to inadequate access to financing to fully implement the program. During the prototype completion and volume production phases, participants encountered costly delays in securing financing. By 1973, all previous hopes that Operation Breakthrough would be a significant remedy to the affordable housing challenge were stymied as President Nixon placed a moratorium on all federal housing programs.

Although Operation Breakthrough has been regarded by most as a failure, it was influential in bringing exposure to the modular housing industry and impacting policy that affects the industry today. Due to the program's publicity, the overall modular housing market increased as many builders were introduced to an alternative method of construction and as new entrants were brought into the modular building trade. As a result of the modular housing industry's increased growth, its leaders were able to

⁶ Daniel Hodes and Mark Jorgensen, *Modular Housing: A Complete Industry Report*, Butler N.J., Housing Research Incorporated, 1971, pp. I 6-7.

exercise lobbying power to influence transportation regulations which resulted in more coordination and uniformity among statewide building codes.

While unsuccessful in meeting its project goals, HUD's Operation Breakthrough program was instrumental in bringing public attention to the modular housing industry and its possible advantages in developing affordable housing. Through the advent of this program local governments, like the City of Boston, became exposed to an alternative building method that could aid in addressing the problem of inadequate supplies of affordable housing in urban centers.

HISTORICAL CONTEXT of MODULAR HOUSING in the CITY of BOSTON

During the mid-1980's, as the City of Boston began to experience dramatic increases in the price of real estate, affordable housing became an issue of high priority for Mayor Ray Flynn's administration. The critical challenge for the Mayor's housing administrators was to discover creative ways to increase the supply of affordable housing while keeping construction and financing costs low.

As market pressures on housing became more severe, many low income and moderate-income families found it more difficult to afford the units they currently occupied. Families being priced out of the real estate market were forced out of certain neighborhoods and moderate-income families found it difficult to enter the homeownership market. The difficulty in finding affordable housing was exacerbated by an overall decrease in the net supply of affordable housing units in Boston.

Between 1960 and 1980, 26,000 units of low and moderate housing were built in Boston but the net supply of units decreased by 18,000. This loss occurred for a number of reasons. During this time period 12,000 apartment units were converted to expensive condominiums. An estimate of 11,000 units were demolished in the poorer neighborhoods, and approximately 4000 public housing units, or almost 25% of the total, became vacant or inhabitable between 1970 and 1980.⁷ In addition, the spread of 'arson-for-profit' destroyed many units.

⁷ Daniel Golden and David Mehegan, "The Crunch Hits Home for Many of Low and Middle Income," *Boston Globe*, 21 September 1983, p.2.

During the late 1960's and 1970's, arson-for-profit became a prevalent practice in sections of Boston's Dorchester, Roxbury, and Mattapan neighborhoods. This period marked an era of mass exodus of whites from inner-city neighborhoods to the suburbs. With plans to move out of the inner-city for fear of an influx of African-American families moving into their neighborhoods, some property owners engaged in arson-for-profit practices in order to quickly recoup value from their properties from insurance claims.

A consortium of Boston banks, known as the Boston Bankers Urban Renewal Group (B-BURG) were in part responsible for abetting white-flight from Dorchester, Roxbury, and Mattapan and for creating a climate where arson-for profit tactics became a way out of unforeseen lending traps. These banks engaged in unscrupulous lending practices with the intention of exploiting buyers and sellers in a volatile housing market. A sum of \$29 million in federally insured mortgages was made available to minority families, but only if they expressed an interest in purchasing homes within certain Boston neighborhoods.

Many banks must take major responsibility for creating instability in the housing market which allowed them to force down sale prices so they could buy a property cheaply for cash from a white family (eager to sale), then resell it to a black family (eager to buy) for an above market price. One study estimated that 65% of the BBURG properties needed substantial rehabilitation work within two years—work the new homeowners had neither the cash nor borrowing power to pay for since many had paid above market prices to begin with. There were no willing buyers to pay as much as the

outstanding mortgages on the properties, so there was no way out for the trapped homeowners. Widespread abandonment, arson, and property demolition followed.⁸

B-BURG's lending practices were responsible for Boston suffering a tremendous loss in its housing stock. In general, the loss of housing had more profound manifestations on the lower income neighborhoods of Dorchester, Roxbury, and Mattapan. The impact of thousands of demolished units resulted in vacant land, pockets of physical deterioration and blight, and overall disinvestment in these communities.

In the early 1980's many people viewed new construction as the natural remedy to increasing the supply of affordable housing and revitalizing the distressed areas of the Dorchester, Roxbury, and Mattapan. While a likely consideration, by the mid-1980's construction and financing cost were on the rise and federal funding sources were on the decline. Therefore, new construction housing by conventional methods did not appear to be a feasible option.

In a research study for Boston's Public Facilities Department (PFD), consultants of the Citizens Housing and Planning Association (CHAPA) assessed alternate construction and production methods by which to develop affordable housing at a high volume and at a lower cost.⁹ Modular housing was one of the development alternatives researched. Although PFD was concerned with high volume production at a cost savings, the agency was also interested in a production method that offered sensitivity to the

⁸ Ada Focer, John Anderson, and Franklin Tucker, *"Bankrupting Families; Bankrupting Neighborhoods: The Case Against Fleet," A Discussion Paper.*

⁹ CHAPA is a statewide advocacy agency for low-income housing.

design of housing units that would complement the existing housing stock in Boston neighborhoods.

Included in CHAPA's final recommendations to PFD, modular housing was presented as a development option that offered the capacity for high volume at a lower cost when compared to the conventional stick-built method of housing production. CHAPA also proposed that PFD consider involving architects in the process of developing design prototypes and standards which would enhance the off the shelf products that modular manufacturers offered.

PFD later followed through with CHAPA's recommendation to involve architects in developing prototype designs for modular units by sponsoring a design competition as part of an effort to develop vacant city-owned land. The competition focused special attention on the designs of three popular Boston building types – the two family, the row house, and the triple decker home. John Sharratt Associates, a Boston architectural firm, was awarded first place in the competition. The firm's design of the two-family home was used to develop 6 affordable housing units in the Roxbury neighborhood of Boston. The units were developed on city-owned land that was later transferred to Project Hope, a non-profit community development corporation (CDC) in Roxbury.

Another example of PFD's use of modular housing was in the initiation of a modular demonstration program. Later in this thesis, I will discuss the experiences of two local CDC's that participated in this program. In Chapter Three, I will briefly

discuss how the perception of modular housing was a barrier for Urban Edge CDC in developing units. In Chapter Five, the experiences of Codman Square NDC will be the focus of a case study.

CHAPTER THREE

Institutional Barriers to Modular Housing Development

Although modular housing is usually perceived as a feasible alternative to developing affordable housing, traditionally, the industry has encountered four primary institutional barriers to development which include: labor unions, transportation, quality, and perception. The purpose of this chapter is to provide an assessment of how these barriers have traditionally impacted the growth of the modular housing industry. In presenting each institutional barrier I will also provide a discussion on how, if at all, these barriers were an impediment to developing modular housing in Boston.

Labor Unions

One of the advantages to using modular housing as an alternative to conventional stick built housing is the lower cost of labor. Unlike conventional methods of housing development, the modular production process is not dependent upon various unionized trades with highly specialized skills. The modular manufacturing process closely resembles the standardized mass production process of automobile assembly. Workers perform repetitive operations at each stage of production and become well trained in their specific task as the housing units move along the production line. The necessity of involving numerous trades to develop a housing unit is eliminated, as usually a single crew of workers is needed for framing, carpentry, drywalling, etc. Therefore, the cost of labor for modular housing is reduced, as fewer laborers with fewer skills are needed.

While the low cost of labor is one advantage to using modular as oppose to stick-built housing, this benefit may be a potential institutional barrier to development in cities with a strong presence of organized labor. For example, in New York City union resistance prevented the development of modular homes by many non-unionized out-of-city and out-of-state manufacturers. While major projects gave rise to factories locating in the city, none survived downturns in the market. The Capsys Corporation addressed these issues by entering into a contract with the industrial division of the United Brotherhood of Carpenters and Joiners which allows organized labor to have an influence in the modular manufacturing process.¹⁰ By the year 2000, Capsys will have completed the development of 645 units of homes for low and moderate-income families in East New York, Brooklyn. This project is being developed for East Brooklyn Congregation, a faith based CDC in Brooklyn.

Though Massachusetts is regarded as one of the pioneering states to institutionalize labor unions and the city of Boston is specifically known for the strength of its building trade unions, resistance from the unions was not a specific threat to the advancement of modular housing in Boston during the 1980's. The lack of widespread union opposition or relative interest in modular housing can be attributed to several interrelated factors: 1) the small scale of the modular projects that were developed; 2) the lack of union familiarity or in-depth knowledge of modular building technology; 3) the selected location in which the modular units were developed; and 4) the robust state of the real estate market. All of these factors combined go a long way towards explaining the lack of union resistance.

¹⁰ Rachelle Garbarine, "645 Modular Homes Going Up in Brooklyn," The New York Times, 4 July 1997.

Traditionally, Boston trade unions have aggressively sought high profile or large-scale building construction projects, such as public buildings, convention centers, downtown office and retail buildings, or large residential developments. Small-scale individual affordable housing projects are typically not the type of work labor unions aggressively seek. The modular projects developed during the 1980's were commonly scattered site in-fill developments that did not garner the type of publicity to command the forthright attention of the labor unions.

While nearly two decades passed since Operation Breakthrough and Boston's introductory experience with modular housing in the mid 1980's, modular building technology was still perceived as a new and emerging method of housing production by those involved in Boston's housing sector. Modular housing was viewed as a development option that had yet to be tested as housing developers, contractors, modular manufacturers, and labor unions were still being educated and acclimated to the industry. At the time, some modular manufacturers lacked the level of expertise to directly compete with conventional homebuilders and in some cases the quality of the modular product did not directly compete with the stick-built home. As the future sustainability of modular housing in Boston was still unclear, one can presume that labor unions were disinclined to oppose a fledgling industry that did not appear to threaten the future dominance of the stick-built home.

The opportunity for developing modular units existed in Dorchester, Roxbury, and Mattapan, communities in which the vast majority of labor union membership did not

reside in the 1980's as compared to years preceding 1960. These neighborhoods experienced large tracts of vacant land, much of which had become vacant as a result of the B-BURG or arson-for-profit scams (explained in Chapter 2). As previously discussed, the manifestation of these practices was rooted in the fear that an influx of African-Americans would enter these neighborhoods, which soon caused white flight by the majority of families to the suburbs.

Before the mid-1980's, labor unions in Boston had not included African-Americans. While this fact has changed somewhat over the years, the majority of the labor union constituency remains largely represented by white males who reside in the suburbs of Boston and beyond. At the time modular housing was being proposed for development in the 1980's, the demographic profile of Dorchester, Roxbury, and Mattapan was largely African –Americans. It is likely that had the units been proposed for development in neighborhoods where labor union representation was very strong, opposition to modular housing would have been vigorous as the union members would have felt directly impacted by the import of labor into their communities.

During the mid-1980's, Boston's real estate market experienced a rapid growth. As the values of homes were rising and mortgage credit became increasingly available, new construction development naturally occurred in sync with the healthy market. Thriving new development opportunities allowed the construction industry, essentially formed by organized labor, the major share of the development pie. Hence, Boston's experience with modular housing in the 1980's did not meet the union threshold as the market for new construction development was in good standing. Holding the previously

discussed factors constant, had Boston experienced a sluggish real estate market during the 1980's it is quite conceivable that modular housing would have received profound resistance, as union members would have organized to maintain the breadth of construction jobs in Boston.

Transportation

The process of shipping modules from factory to site has presented manufacturers with constraints that have impacted the transportation and design of modular housing units. In earlier years, manufacturers encountered a myriad of regulations that caused complications in transporting modular units across various state lines. These complications were particularly severe in cases such as Massachusetts, where state regulations prohibited the travel of particularly types of modules across their jurisdiction. The regulatory laws of travel also had implications for the appearance of the modules, as the design of the units was partly dictated by these restrictions. Through the efforts of industry leaders employing various new methods of industrializing housing, great strides have been made to overcome many of the barriers posed by transportation.

Although the Federal Government sanctioned modular housing through Operation Breakthrough, the interstate transportation laws of many states did not facilitate ease of entry into these markets. Transporting units became an intricate process as regulations regarding the width, length, and weight of the module could vary from one state to the next. The maximum permitted width of the module was specifically problematic as most states imposed an 8 foot width requirement in the early 1970's. Manufacturers judged

that this dimensional injunction did not fit with the practical needs of families purchasing modular and other types of factory produced housing. These companies lobbied to increase the maximum width to 14 feet. Through their efforts 32 states, excluding Massachusetts, changed their highway transport regulations to allow the shipment of 14 feet wide housing units on their state highways. Hence, the process of transporting 14 feet wide modular units across different state lines became a burdensome task for manufacturers with transportation routes through Massachusetts.

The lack of uniformity in state regulations caused manufacturers and subsequently the buyer to incur increased costs for transporting 14 feet wide units as additional miles were traversed and additional time was spent to deliver units to their respective sites. It was not until mid-1970 that the Massachusetts Department of Transportation modified its regulatory laws to allow the transport of 14 feet wide housing units on its state highways.

While manufacturers were successful in working with the legislative bodies of states to modify the regulatory constraints that dictated the width of modular units, there was less success in modifying regulations that dictated the height of units. The constraints placed on modular design, specifically the height and the low rooflines was determined by standard height clearances of overpasses, bridges, and viaducts. The majority of highway regulatory laws required the maximum height above the road surface to equal 13 feet 6 inches. The height restriction clearly had an impact on modular developments, in-fill or otherwise, that were placed in older urban communities, as the modules did not fit within the context of these neighborhoods where mid-rise and high-rise housing was the norm.

The constraint on the height of modular units was a challenging barrier. While modular manufacturers could not overcome it through political measures (i.e. lobbying to increase the maximum height of clearances), they were able to overcome the height restrictions in the late 1980's through innovative technological measures. Modules with peaked roofs are generally designed with fold down roof systems. A single pivot at the roof and wall connection permitted slopes of 7:12 – too shallow when compared with traditional urban roof slopes. Through the advancements in the design of modular roof systems, additional pivots or sliding mechanisms permitted slopes of 12:12 or more.¹¹ Essentially, modules were shipped as a flat roof and raised on site. Thus, modular manufacturers were able to incorporate higher pitch roofs into the design of modular units.

In Boston's first experience with modular housing, transportation was not a barrier to development. Given the nature of Boston's narrow and non-grid conforming streets patterns, access to development sites in Dorchester, Roxbury, and Mattapan did not appear to be an obstacle. In locations where modular units were developed on tracts of assembled vacant land, proper maneuvering around the site was allowed without much effort. While in-fill developments presented more of a challenge, no highly unique provisions were used to allow modular development to occur.

The manufacturers that participated in the projects were primarily located in New Hampshire and Maine. By this time more uniformity existed in the regulatory laws of

¹¹ Public Facilities Department, "Modular Urban Housing: A Design Challenge," Boston: 1989, p. 20.

interstate travel among New England states which allowed transportation costs to be stabilized and not to be a barrier to development. Nonetheless, this cost ought to be closely assessed when determining the potential cost savings of a modular project. In a recent study by the Department of Neighborhood Development (DND), the associated cost of transporting a typical two story structure from Claremont, New Hampshire to Boston, Massachusetts was calculated as follows: Each 'box' cost \$1.00 per mile traveled from the factory and an additional charge of \$50.00 per module when crossing the state border from New Hampshire to Massachusetts. Therefore (4) units; first floor left side, first floor right side, second floor left side and second floor right side, delivered to a Roxbury site from Claremont at a distance of about 100 miles would be 100 miles x \$1.00 per mile plus \$50.00 DOT (Department of Transportation) charge, would add \$600.00 to the overall cost.¹² While this may not be considered an exorbitant cost in terms of the overall cost of a project, transportation cost can readily increase depending on the number of housing units to be developed, the square footage of the units, and the number of modules necessary to comprise a complete housing unit. Transportation should be recognized therefore as a direct cost in a modular housing project.

Quality

Since the early days of Operation Breakthrough, modular housing manufacturers have continuously worked to enter new markets by emphasizing the high quality of their product. Many manufacturers have experienced difficulty in introducing and integrating

¹² Steve Brittan, Dom Guarnagia, Matt Miller, David West, "*Modular Housing Analysis*," 1 December 1997, p. 8.

their product in uncharted markets because of preconceived association of modular homes with mobile/manufactured homes (which are typically of a lower quality), and therefore the view that the modular home is of an inferior quality to the conventional home.

HUD Code is the building compliance standard by which mobile/manufactured homes are constructed. While the specifications of the HUD Code have improved over the years, the standards are less stringent than building codes applying to modular housing. Mobile/manufactured homes are less durable and are viewed to be of a lower quality as compared to the modular home.

The preconception that the modular home is of an inferior quality to the conventional stick-built home is incorrect as both building types are constructed according to the same construction codes -- typically BOCA (Building Officials Conference of America) or UBC (Uniform Building Code). Although modular and stick-built homes are built according to the same compliance codes, many modular manufacturers will argue that the modular home exceeds the quality of a stick-built home. This argument is based on the fact that the structural framing system of the modular unit is built to withstand the stresses of factory handling, highway transportation, and site erection. Therefore the units are overbuilt in terms of demands actually made on it when in place.

The quality standards of the modules were not an issue in Boston's previous experience with modular housing. However, in one case the quality of the buttoning up

process was so poor that PFD used approximately \$10,000 in additional funds to make repairs to the project. The problems included modules not properly attached to the foundation, not correctly connected by the marriage wall, and water seepage into the units as a result flashing not properly attached to the units. These problems occurred primarily as a result of the inexperience of the modular manufacturer that oversaw this work. The company went out of business soon after this project was completed.

Perception

For many with limited familiarity of the modular housing industry, at first response the typical association of this housing types dates back to prefabricated housing of the post World War II era or mobile homes. In an attempt to assuage the housing shortage after the war, prefabricated housing was used to mass-produce housing in the most expedient fashion. Unfortunately, the result of this effort was a mass-produced housing stock of poor quality that lacked any sort of aesthetic character. As discussed in the section on 'Quality', the perception of modular housing has also been in association with mobile homes. In the 1950's the unbounded proliferation of low quality mobile homes gave the image of modular technology its most striking setback. They were, after all, just trailers, "double-wides" built for a transient lifestyle.¹³

In previous years this perception and association with mobile homes had an impact on sales and mortgage financing for modular homes. Osmun Soyer, a former

¹³ Public Facilities Department, "Modular Urban Housing: A Design Challenge," Boston: 1989, p. 10.

president of a modular manufacturing plant in North Carolina recounts, “one of the biggest obstacles to sales of modular units was the tendency of the public to equate modular housing with mobile homes in trailer parks.” The company encountered problems with financing modular homes from savings and loan associations and banks. Osmun states, “The bankers feel that since single-family home sections are trucked in, the house could also be moved to avoid eviction or foreclosure. So bankers usually charge 3 to 5 percentage points higher interest rates for modular than stick built homes.”¹⁴

Another popular misconception is that today’s modular manufacturer is limited to producing the type of housing unit that can only be contextually applicable to rural and suburban settings. This perception was indeed a reality in the past, but the industry has made advancements that allow the production of housing units that are compatible to the existing fabric of urban communities. No longer are ranch style homes one of the few options for consumers considering modular housing. Manufacturers have come to understand that to market their product to a wider variety of consumers, particularly consumer markets in urban regions, they should provide several different models for consideration -- this which also involves being more conscience of design.

Donald Carlson, editor of a housing trade magazine, acknowledges the designs of modular homes were at one time terrible.¹⁵ “They were very boxy and unimaginative in appearance. But now the modular industry has finally discovered architects and

¹⁴ Thomas Rohan. “*Affordable Homes From a Factory: One Answer to a Social Crisis*,” *Industry Week*, 10 January 1989, p. 38.

¹⁵ J. Lang Davison. “*Modular Housing Under Improvement As Production Booms*,” *New England Business*, 7 May 1984, p. 54.

designers.” Presently, there are many manufacturers that involve architects in the design process. While intricate levels of detail cannot be expected from a modular home, as this is restricted by the nature of the modular manufacturing process, there are enough areas where customization can be implemented.

One example in Boston’s experience of developing modular housing where the perception of modular housing was a barrier to development occurred when Urban Edge, a non-profit CDC in Roxbury, attempted to develop modular housing in its bordering neighborhood of Rosindale. Urban Edge purchased several city-owned vacant parcels to develop affordable housing. Unfortunately, the community opposed the CDC’s plans for development citing the vacant land should be preserved as open space.

According to Mossiak Hacoban, Executive Director of Urban Edge, the vacant land had been a dumping ground for several years and if the community had a real interest in preserving the land as open space they would have worked towards this goal long before Urban Edge’s proposal for development. It is Hacoban’s assumption that the community opposed this project in part because it was a modular development. Although the CDC received zoning approvals for the development, it was not able to proceed with the project because an abutter to the site filed a last minute appeal to the project. After 10 years in court, Urban Edge recently won the appeal to proceed with developing this site. Urban Edge has not yet determined if it will develop housing on the site using modular building technology.

CHAPTER FOUR

Cost Savings in Modular Housing

Modular building technology is primarily considered an option for housing development because of its potential cost savings. Manufacturers in the industry often cite savings of 10-20% in comparison to the conventional stick-built home. The potential savings can be realized in the hard costs as well as in the soft costs of construction. The savings in the hard cost are in the direct per square footage cost of a unit and the savings in the soft costs are in construction financing and in the elimination of an architect's fee. Additionally, savings can be realized in the cost of labor and by the efficiency of the production process.

While the modular housing offers several areas where savings can be realized, one can only recognize these savings if the advantages of the modular production process are fully understood and utilized. This section provides a detailed discussion of each area that modular housing has the potential to offer savings and also discusses how transportation is accounted as a direct cost in modular housing.

Direct Construction Savings

By the standardized/repetitive nature of the modular manufacturing process, which closely resembles the methodical linear process of automobile assembly, the comparative square footage cost of a modular home is lower than the conventional stick-built cost. In modular projects where the Department of Neighborhood Development

(DND) has been involved, the cost of the modular units was generally 47% for single family units and 42% for duplex units of the total construction cost. In these projects, the per square foot cost of the boxes averaged \$36/SF, while the site work, buttoning-up work, and 'after-market' additions (i.e., porches, gutters and trim) added \$40-50 a square foot to the cost. The comparative total square footage cost of a modular unit to the average stick-built unit was \$76-86SF and \$95-105SF, respectively.¹⁶ These cost comparisons only reflect the cost of constructing the housing unit. Therefore, the dollar for dollar cost of a modular unit is less than the conventional stick-built unit.

Architectural / Construction Financing Savings

Two line items in a construction budget where modular housing offers a saving in the soft cost are in construction financing and architectural fees. In conventional stick-built housing the builder starts paying interest with the first shipment of raw materials to the site. Depending on the type of development, construction may take 9 to 12 months for completion. This time frame may be lengthened depending on the productivity of the work crew, weather conditions, or any other inconceivable delays. Therefore, there is less predictability in determining the exact time period of construction in conventional stick-built housing.

On the other hand, construction financing for modular housing begins to accrue when the units are delivered to the site. Once the foundation is cured and other measures of preparing the site are complete, final erection of the module can take place. The skill

¹⁶ Steve Brittan, Dom Guarnagia, Matt Miller, David West, "Modular Housing Analysis," 1 December 1997, p. 7.

level of the work crew is a factor in determining the amount of time to set the modules. A four or six box house can take as little as a few hours or as long as two or more days to be set. This process involves attaching the modules to the foundation and adjoining the modules by their marriage wall. Finally, any remaining work that could not be executed in the factory is done on site, which may include the completion of any necessary roofing or siding details, the construction of porches, stairs, or decks, plumbing, electrical, and mechanical connections between the modules, on-site utility connections, and all other finish work. On average, this process may take up to 5-20 working days. Therefore, the construction financing would apply for approximately a one week to three week period rather than a 9 to 12 month period as in stick-built housing.

Modular housing also offers a saving in the soft costs that would apply towards the services of an architect, as more of the direct responsibilities of an architect are eliminated from the manufacturing process. In conventional stick-built housing, the architect is primarily involved in three phases of the design/development process: 1) schematic design; 2) construction drawings; and 3) construction supervision. The architect is typically appropriated a 3-6% contract fee as a percentage of the total development cost of the project.

Unlike stick-built housing, the services of an architect in developing schematic designs, developing construction drawings, and construction supervision are integrated into the modular manufacturing process. Therefore, the independent services of an architect are eliminated in modular housing.

Most manufacturers have a standard set schematic designs or the designs may be altered to fit the needs of the consumer. Architects are either part of a production team that generates designs for the units or the team consists of a staff with experience in operating computer automated design systems such as CAD (Computer Automated Drafting). Employing computerized stock designs and modular construction processes also pays off in the quick generation of drawings, the need for fewer drawings, and the more efficient utilization of those drawings produced. Once a design is finalized (and the assembly line is prepared to construct a module) all required construction drawings can instantly be harvested from the computer, and concurrently distributed to the applicable person/steps in the modular assembly line. In addition, construction/assembly techniques, materials and methods are repeated again and again, effectively eliminating the need for most detail drawings. Finally, the architect's role in providing construction supervision in the modular manufacturing process is eliminated. As the housing unit moves along the production line supervision is an integral part of the factory based construction process.

Other Potential Areas of Savings

The consumer should not automatically expect a cost saving in modular housing if the manufacturing process is not used a wholesale method of production. To be cost efficient, modular housing must be mass-produced in quantity. Building one or two homes a week in a factory and shipping them to the site is certainly producing modular housing, but it is not taking advantage of the production opportunities a manufacturing

environment presents. Mass production, to be effective must be repetitive. The concept of modular manufacturing is to have a standard-size unit using similar materials with a minimum number of changes, which allows the square footage cost of the unit to be lowered.¹⁷

Controlling the environment in which the manufacturing process takes place works to stabilize the cost of modular housing. The standardized and repetitive nature of the process ensures less waste, as materials are precut to uniform sizes and assembly is done by using a jig which properly secures the materials in place. This system works as a safeguard for accuracy which minimizing opportunities for error -- fewer errors cost less to correct.

Modular housing offers additional savings in the cost of labor as compared to conventional housing. The savings in labor is recognized by using a smaller crew of non-unionized workers with less skills. The profile of this type of workforce is particularly beneficial for the manufacturer developing housing in an area where there exists a shortage of highly skilled local tradespeople.

While modular housing can offer a potential savings, costs can increase if various components are not clearly defined or are misunderstood by either the person(s) charged with coordinating the process or by the person(s) responsible for one of the component portions.¹⁸ Cost overruns can also occur if the manufacturer does not adequately perform their responsibilities in the buttoning up procedures.

¹⁷ William Nolan. "Modular Housing Can Help Alleviate the Nation's Housing Crunch," *The Real Estate Journal*, Summer 1988, p. 88-89.

¹⁸ Public Facilities Department, "Modular Urban Housing: A Design Challenge," Boston: 1989, p. 6.

CHPATER FIVE

Modular Housing and the Codman Square NDC: A Case Study

By the close of 1998, Codman Square Neighborhood Development Corporation (NDC) will celebrate its seventeenth year anniversary as a non-profit community development corporation serving the Codman Square neighborhood in Dorchester. The NDC, formerly the Codman Square Community Development Corporation, was originally organized around the initiative of community-based economic development. Specifically the organization's primary focus was the revitalization of Codman Square's commercial district on Washington Street, which had become an eyesore to the community.

Over the years the NDC began to establish a more comprehensive approach towards neighborhood stability and revitalization. The protecting and preserving of affordable housing along with the general fabric of the Codman Square neighborhood, and participating in community/resident organizing soon became areas in which the NDC began to direct its attention.

During the late 1980's and early 1990, Codman Square and its peripheral neighborhoods began to experience a rash of foreclosures and abandonment of one-to-four family properties. The NDC and neighborhood leaders identified these events as the result of investor speculation and second mortgage scams similar to activity that had destabilized the neighborhood in previous years. In response to these incidences, the

NDC became actively involved in improving and securing stable ownership of the neighborhood's housing stock. The strategy for promoting stability was to rehabilitate and sell one-to-four family properties to first-time owner occupant homebuyers and to inform the community of the fraudulent practices of predators seeking a profit off of an unsuspecting community.

In addition to stabilizing small residential properties, the NDC began concentrating its efforts on the rehabilitation of large multifamily building. Several such buildings were identified and successfully rehabilitated to provide well-maintained, affordable rental housing for low and moderate-income families. Unfortunately, the successful longevity of some of the newly renovated properties was threatened, as the neighborhood in which they were located became a haven for criminal activities. In an effort to "take back their buildings," the NDC established a strategic partnership relationship with the residents of the buildings. The collaboration effectively worked to preserve the properties and create a safer community. This process served as a catalyst for future initiatives to proactively engage neighborhood residents in community building endeavors.

Recognizing the need to develop a comprehensive approach towards community development, the NDC appropriately adopted an organizational mission to adequately serve its community. The NDC's mission is to improve the quality of life for all Codman Square residents through initiatives which include housing development, economic development, and community building which engages residents, local businesses, and other non-profit organizations in the area in participatory planning processes.

The commitment to upholding this mission is reflected in the NDC's contributions to the Codman Square community. To date, the development accomplishments include providing over 600 units of affordable housing to low and moderate-income families and providing over 25,000 square feet of commercial space to local businesses in the area. The community building accomplishments include working with residents to organize and develop civic associations, collaborating with neighborhood organizations to devise strategies to reuse vacant land in the community, and working with Codman Square merchants and neighborhood councils to encourage public safety in the business district.

One of the NDC's most recent initiatives involved collaborating with neighborhood organizations to devise a comprehensive revitalization plan that targets one of the more distressed sub-neighborhoods within the NDC's service area -- the Erie/Ellington neighborhood. The plan calls for revitalizing this residential neighborhood by developing new construction housing on tracts of land that has remained vacant for years. Most specific to this thesis is the building method by which the NDC will construct the housing units. The housing units will be developed using modular building technology, an alternative to conventional site built housing

Codman Square NDC and Modular Housing: The Experience in the 1980's

The option to use modular building technology as a method of developing affordable housing was originally pursued by Codman Square NDC in 1984. In response to an RFP issued by the Public Facilities Department (PFD), the NDC was awarded a

grant to participate in a modular demonstration program to explore the opportunities that such housing provided for developing affordable housing. As a result of this initiative, the NDC developed 21 units of affordable housing.

According to Bill Jones, Executive Director of the NDC at the time of this initiative, the NDC had three objectives in participating in PFD's modular demonstration program: 1) to make use of a vacant school site by developing new construction housing which would create homeownership opportunities for low and moderate income families; 2) to develop new construction housing by making use of a alternative method of building technology; and 3) to determine if modular building technology offered a cost savings.

The site where the modular units were developed was that of a former elementary school in the NDC's service area. This parcel had become available for development as a result of the Champlain School's demolition. The NDC viewed this site as an ideal location to develop affordable housing and enhance the market of homeownership in the area.

Participation in the modular demonstration program allowed the NDC to capitalize on an opportunity to develop new construction housing and to understand the process of successfully marketing and selling new homes. Until this point, the NDC's sole experience in the housing sector was in the acquisition, rehab, and sale of abandoned and foreclosed properties. While rehabbing abandoned properties worked to help stabilize neighborhoods, the NDC judged that new construction would have a more profound affect on areas impacted by the profuse amount of vacant land. In effect, new

construction housing would demonstrate that a neighborhood once filled with vacant land had the capacity not only to become stabilized, but also to thrive with new investment.

Bill Jones comments on the comparative impact of rehabbing existing housing versus developing new construction housing in a neighborhood:

While the NDC had been engaged in the process of rehabbing homes, often times this is invisible within the neighborhood, particularly to the outside. People on an immediate block may notice when a building becomes abandoned, fixed up, and then when somebody eventually moves in. But, if you're really trying to persuade outside investors, in this case banks and other people who would support what you were doing, it was real hard to bring them through and say this one house was recently rehabbed...it's like saying yeah, so what. On the other hand, to say that we just built 21 units of new construction housing, and you could see that it was quality housing but not necessarily housing that had been there forty years, there was a dramatic difference in terms of their perception on the affect it had on the neighborhood.

Thus, new construction housing provided the NDC with the opportunity to show that the School Street neighborhood had the ability to thrive.

In addition to developing new construction housing, this process allowed the NDC to understand how to properly market and sell new homes --- which was critical to this project. In response to the question, in what ways did this project serve as a mechanism for applying applicable skills to future projects, Jones commented: "This project was an important learning experience for the NDC. Not only did we learn about new construction and modular building technology, but we also learned about how to successfully market homes and how to structure pricing." As a result the NDC received 600 applications from individuals interested in purchasing the homes, of which 200 applicants were financially qualified to purchase. A lottery system was used to determine the final homeowners of the 21 housing units.

The Modular Demonstration Program allowed the NDC the make use of a development opportunity while being one of the few local CDC's implementing an alternative method of building technology. PFD's encouragement and enthusiasm for the new technology further reinforced the NDC's interest in modular housing. Prior to PFD and the Building Department conducting research on modular housing, many observers had been skeptical of its use in Boston neighborhoods. The stereotypical assumption of modular homes was that of trailers or homes that resembled barracks. The education process of learning about the industry involved having the staff of these departments along with and CDC's, visit modular manufacturing plants to determine the possibilities of the product. These tours resulted in the NDC learning that modular homes had the capacity to be architecturally attractive and to fit within the context of their neighborhood. Additionally, as a result of this learning and inspection process, the Building Department allowed blanket approvals on the structural quality and integrity of products from these specific plants.

Codman Square NDC's final objective in participating in the modular demonstration program was to determine if modular housing potentially offered a lower development cost for new construction housing. The preposition that modular homes offered notable savings in cost as compared to new construction stick-built housing made it an attractive development option for the NDC to consider. In response to the question, if indeed, modular housing offered a significant savings, Bill Jones answered 'no'. He comments:

"If someone were to say the reason for doing modular housing is because of its significant cost savings, I would have to disagree. There are some reasons for doing modular, but cost isn't necessarily one of them. It turns

out in the final analysis of this project that our savings were minimal... The marginal difference in the project cost when compared to stick-built housing was in the construction financing. But when you think about construction financing as a percentage of a project of this size, it's an insignificant cost. This project may have been a little cheaper to build but the savings were immaterial."

Jones recounts the construction cost was approximately \$60,000 per unit, therefore the total construction cost for the 21 unit development was approximately \$1.3 million. Jones did not regard this amount as a savings for an affordable housing project developed in 1984/85.

While modular building technology did not offer the NDC a significant saving in construction cost, it provided the benefit of dramatically changing a neighborhood in a relatively short amount of time. According to Jones, one of the successes of the project was its rapid impact on the neighborhood. The approximate time line of the project was as follows: summer of 1984, the NDC began informal discussions of modular housing with PFD; October of 1984, PFD issued the RFP for the Modular Demonstration Program; the NDC responded to the RFP and received its notice of award and started the process in December of 1984; by September of 1985 all units were built, sold and conveyed (with the exception of one that had special circumstances). Jones acknowledged that such an expedient process would never have been possible had the conventional stick-built method of construction been used in the development process. The modular building process allowed the NDC to avoid countless delays that might have resulted from inclement weather, site, or construction problems.

Jones recognized the successes of the NDC's implementation of the Modular Demonstration Program and felt there were no specific aspects of the project which were viewed as having failed. However, he did acknowledge the existence of failures within the process of attempting to further implement the use of modular housing in developing affordable housing in Boston. Jones' explanation for the lack of the modular housing industry's growth in Boston was due in part to an administration change in the Public Facilities Department (PFD) and the surge in housing construction in 1988.

Paul Grogan was the Director of PFD during the administration of the Modular Demonstration Program. Later in the 1980's Lisa Chapnick assumed this position. Jones recalls that after Grogan's tenure at PFD there was no real marketing of modular housing or the pursuit of its use as an objective:

“...when Grogan left PFD modular housing was at a fragile state and needed to be promoted, marketed, and sold. That wasn't what Lisa came to do and it sort of just fell by the wayside, different people have different interest...People still did modular for a while but it was not the vogue thing to do so it never really got a foothold in the market.”

Although the Modular Design Competition (discussed in Chapter Three) was implemented in 1988 while Lisa Chapnick was Director of PFD, this program was conceived and planned during Paul Grogan's administration.

An additional factor that Bill Jones attributes to the stagnated growth of modular housing in Boston was, as he described, the housing boom 1988. As housing construction was on the rise, some manufacturers supplying modular homes to Boston encountered difficulty in producing units in a timely fashion. While not recognizing one

of the supposed ‘prime advantages’ to using modular building technology, many reverted back to the conventional method of housing construction. This is one of the inherent downsides to the use of modular housing.

Modular manufacturers are highly sensitive to economic upturns or downturns in the housing market. A manufacturer’s ability to deliver units according to schedule is dependent upon the production capacity of the factory. If the manufacturing plant is operating behind schedule, because it has received more orders during a particular season than anticipated, this results in the delivery schedule of future projects being delayed. Unlike the conventional stick builder that can meet increases in the demand of housing by employing additional labor and purchasing more material, the modular manufacturer’s ability to rapidly respond to increases in the demand is constrained by the production process of the factory. Additionally, as economic entities, modular manufacturers are not capable of responding to increases in demand by assuming the exorbitant overhead cost to rapidly expand their facilities or construct new factories.

Although the NDC did not recognize the anticipated significant cost savings by using modular building technology, Bill Jones’ final impression of the project is that it was a successful initiative and worthwhile endeavor. Participation in the Modular Demonstration Program served as a valuable learning experience for the NDC and an opportunity to dramatically impact a once blighted neighborhood in its service area.

Codman Square NDC and Modular Housing: The Experience in the 1990's

After more than a decade since Codman Square NDC participated in the Modular Demonstration Program in 1984-1985, the subject of modular housing is once again a topic of discussion at the NDC. The City of Boston's Department of Neighborhood Development (DND), formerly the Public Facilities Department (PFD), is reevaluating the use of modular building technology to develop affordable housing in Boston and has reintroduced this method of construction to the NDC. At the encouragement of DND, Jim Ferris (Executive Director of the NDC) and Ann Houston (Director of Development at the NDC) are pursuing a housing initiative to develop 50 units of modular housing in the Erie/Ellington neighborhood of the NDC's service area. (*Erie/Ellington is located in the northwestern section of the service area -- see Exhibit 2 for a location map*). The NDC views modular building technology as an opportunity to develop affordable rental housing while bringing stability and new construction investment to an area that has endured blight partly caused by prolific amounts of vacant land. One of the NDC's first step's in moving forward with the process of developing modular housing in Erie/Ellington was identifying and securing ownership of vacant parcels in this area.

In comparison to other neighborhoods within the NDC's service area, the Erie/Ellington neighborhood has a very high proportion of vacant land, the majority of which has remained undeveloped for over twenty years. Many of these of the parcels became vacant as a result of the B-BURG lending practices of the late 1960's and 1970's

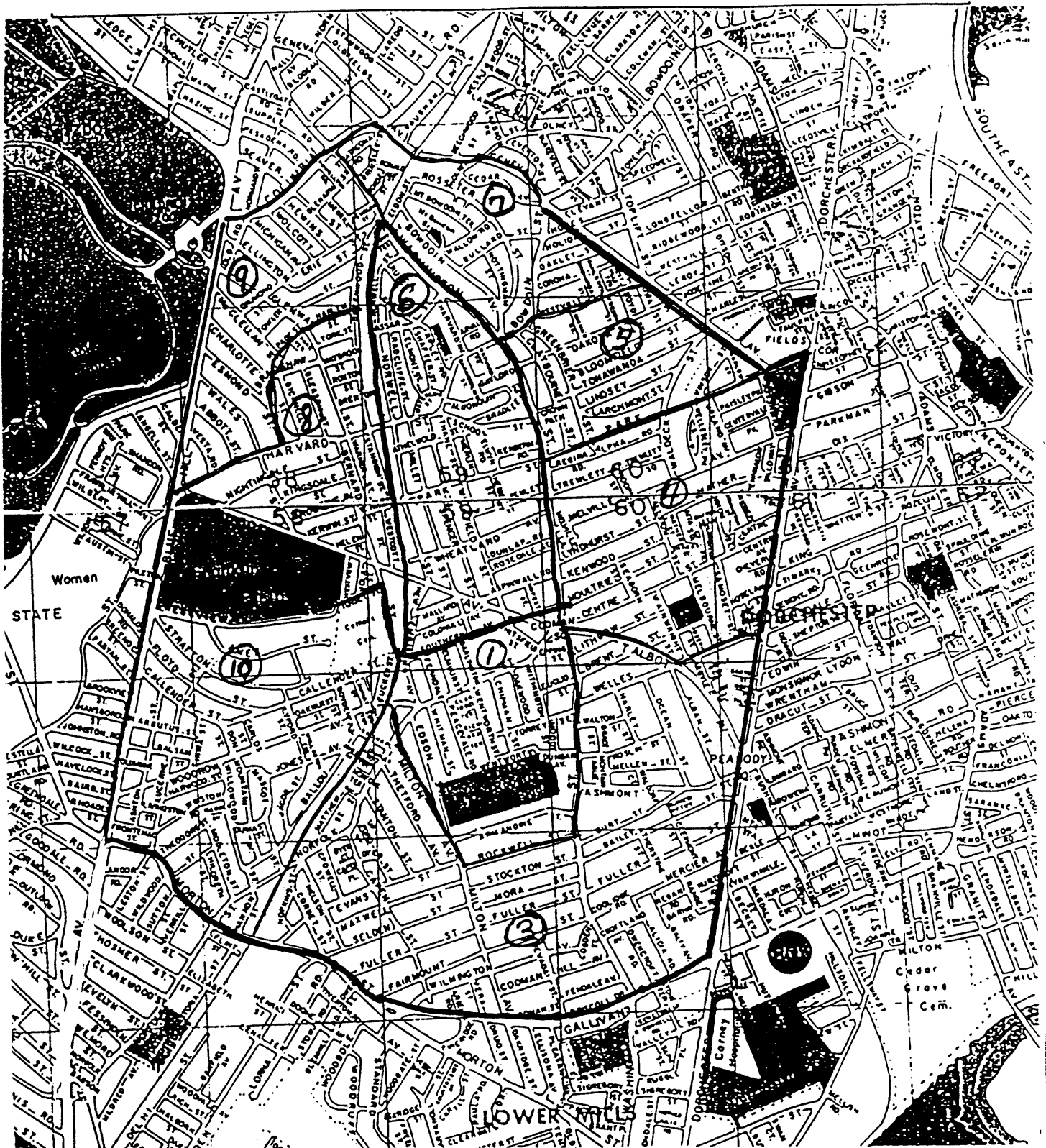


Exhibit 1: Codman Square NDC's Service Area



EXHIBIT 2: Location Map of the Erie/Ellington Neighborhood

(discussed in Chapter Two). Properties were eventually condemned either because of foreclosure, owner abandonment, or because of arson for profit scams that left decadent properties causing health, safety, and environmental hazards to the neighborhood.

Within the last year Codman Square NDC has assumed title of ownership to the majority of vacant parcels in the central core of the Erie/Ellington neighborhood. Prior to the NDC's control of this land, the City of Boston owned many of the parcels. Several were owned by the Jacobs Place Affordable Housing Trust, a now defunct organization. The NDC obtained control of the city owned parcels by responding to a land Request for Proposal (RFP) by DND and were transferred title of ownership to the land for one dollar.

The remaining parcels were assumed from the Jacobs Place Affordable Housing Trust. This organization was also vested in a mission to stabilize the Erie/Ellington neighborhood through the development of new construction housing. The Trust obtained title to several vacant parcels in this area with the intention of developing condominium units for low to moderate-income families. In 1992, Jacobs Place Affordable Housing Trust was successful in developing 12 condominium units. This was the first time in thirty years that new construction development occurred in Erie/Ellington. Though additional units were planned for development, the Trust was unable to facilitate its plans due to financial difficulties that forced the organization into bankruptcy. In the fall of 1997, the NDC assumed title of ownership to the Trust's remaining portfolio of undeveloped land.

In obtaining control of a large portion of the vacant land in Erie/Ellington, the NDC has secured its interest in revitalizing the neighborhood through the housing development. As this project moves forward, Jim Ferris (Executive Director of the NDC) and Ann Houston (Director of Development at the NDC) should consider the tradeoffs in using modular building technology to develop affordable housing in this area.

The Tradeoffs in Developing Modular Housing

In pursuing the use of modular building technology to develop 50 units of affordable housing, the NDC's primary objective was to recognize a significant savings in the development cost of this project. However, based on the manner in which the NDC has proceeded with implementing its plans for development, it is not apparent the organization will recognize the optimal savings that modular housing has to offer. This section provides a discussion of the tradeoffs the NDC has made in choosing to developing modular housing.

Design

In planning the Erie/Ellington development, the NDC was very conscientious about the aesthetic character of the modular units. Having reviewed the project portfolios of several manufacturers, the NDC was not particularly impressed with their designs and subsequently sought the services of an architect to ensure the highest quality of design. In obtaining the services of an architect, the NDC is essentially implementing the element of design as a function external to the manufacturing process and will therefore incur this added cost.

As discussed in Chapter Four, an area of savings that modular housing offers is the elimination of the services of an architect, as design is implemented into the manufacturing process. While manufacturers usually have a standard set of designs from which to choose, many are flexible and work with the consumer to develop the appropriate designs for their needs.

The NDC also used the services of the architect to ensure the design of the units would fit with the context of the Erie/Ellington neighborhood. The housing stock in the immediate area of the development primarily consists of single and two family homes with diverse design features and facades. These homes do not resemble cookie cutter housing models that are common in many suburban communities.

To maximize the use of the mass / wholesale production process of a modular manufacturing plant, units should be developed with consistent designs (the cookie cutter suburban model of development). If the NDC were to take advantage of this type of efficiency, the Erie/Ellington development would consist of 50 units with 50 identical designs. While this may be the ideal method of utilizing the efficiency of the modular manufacturing process, the NDC recognizes it would not be appropriate for this development to resemble that of a suburban community.

By the same token, the NDC recognizes that by the nature of the modular manufacturing process it would be highly inefficient to utilize a retail system of production to develop 50 units of housing. In an attempt to make use of the wholesale

production process while adding while aesthetic character to the development, the NDC will use three variations in the design of the units.

While the element of design was a primary concern for the NDC, in presenting the schematic designs of the project to the community, residents expressed more concern for the type of ownership of the housing units than for their design. The NDC's plans called for developing 50 units of rental housing. The community has emphatically expressed to the NDC that homeownership is the way to revitalize and bring stability to the Erie/Ellington neighborhood.

In retrospect, Ann Houston has stated, she is convinced the final designs of the architect could have been replicated by a modular manufacturer. Unfortunately, this potential cost savings has already been forgone.

Labor / Labor Unions

The NDC's goal to develop 50 modular housing units may be interpreted as an objective that works in conflict with the organization's economic development initiative. In part, the initiative seeks to create job opportunities for community residents. Presently, there are no modular manufacturing plants in Boston or in the state of Massachusetts. Therefore, the NDC will have to export all of the labor necessary to develop the housing units. If the conventional method of construction were used, the NDC could require the contractor to employ a certain percentage of laborers from the

Dorchester community or surrounding neighborhoods. In essence, this project could be leveraged to develop affordable housing and to create local jobs.

While presently, there are no modular manufacturers in Boston or Massachusetts, two companies have voiced an interest in locating in Boston. According to Ann Houston, Kaiser Industries (presently located in New Hampshire) has recently expressed an interest in locating a plant in Boston and within the last year the Green Village Company approached DND with a development proposal to locate a plant in Boston. Green Village identified a site in Dorchester as one location in which to setup its factory.

While it does not appear that organized labor will be a threat to the advancement of the NDC's modular housing initiative, it is quite possible they would voice opposition to a modular plant locating in Boston. It is likely that the unions may perceive the existence of a modular plant in Boston as a long-term threat to local building competition. Understanding the influence that organized labor may have in thwarting this process, Green Village has been proactive in its attempt to establish working relations with unions. The company's strategy is to allow the unions to have an influence in the manufacturing process by allowing some of the workers to be unionized (i.e. line foremen, supervisors).

If Green Village is successful in its attempts to establish a plant in Boston this would be an asset for the local economy in Boston, but it would be a disadvantage to the consumer of modular units. While the plant would create additional jobs for local residents, the modular consumer would not necessarily benefit as the comparative cost of

employing unionized workers versus non-unionized will increase. As previously discussed, one of the areas that modular housing offers a savings is in the cost of labor where the workforce is comprised of non-unionized laborers with low skills. It is not likely the discussion of locating a modular plant will affect the NDC, as the development of Erie/Ellington will occur before the winter of 1998.

On-Site Work

Although the structural integrity of modular housing is no longer questioned, the quality of the button-up work is sometimes poor. Specifically, the process of properly attaching the module to the foundation and detail work such properly installing flashing to prevent water seepage into the units. As discussed in Chapter Three, in Boston's previous experience in developing modular housing, there were some incidences where the button-up work was very poor and PFD had to use additional funds to amend the problems.

The NDC has taken these circumstances into consideration as it plans to develop modular housing. To ensure all site-work is of high quality, the NDC will contract out the services of a full-time project manager with experience in working with modular housing to monitor this process. By hiring a project manager to supervise this process, the NDC is not optimally using the services of the manufacturer who normally oversees this work.

CONCLUSION

As developers and builders search for cost efficient methods of developing affordable housing, many consider the use of modular building technology to achieve cost savings. While modular housing has the potential to offer savings, it should not be assumed that automatic savings will be realized from this method of building technology. To take advantage of the cost savings that modular housing has to offer, one must understand and fully implement the modular production process in a manner that will in fact result in reduced costs.

This chapter provides an assessment of how well Codman Square NDC has used the efficiencies of the modular production process in its plans to develop 50 units of modular housing. In the NDC's first experience of using modular building technology, cost was not the principle factor in its decision to use this alternative method of housing development. However, the NDC's present motivation for considering the use of modular housing is primarily to recognize significant savings in cost. Unfortunately, it does not appear that the NDC will realize the optimal savings that modular housing has to offer. The NDC has made tradeoffs in its use of modular housing which will have an impact on the final cost of this project and in the organization's partial fulfillment of its economic development objective.

By participating in the Modular Demonstration Program in the 1980's, the NDC was allowed the opportunity to develop affordable housing and demonstrate its capacity to revitalize a blighted neighborhood of its service area. Although a cost savings was not realized, this project was considered successful as the use of modular building technology

allowed the NDC to dramatically improve the neighborhood in a relatively short period of time. Thus fast production, more than cost reduction, was important.

As the NDC seeks to use modular housing in its present plans to develop affordable housing, it is specifically interested in recognizing the maximum savings that modular building technology has to offer. In obtaining the services of the architect to develop schematic designs for the project and a construction manager to monitor the on-site buttoning up process, the NDC will incur these additional costs that could have been integrated into the manufacturing process. Therefore, in making tradeoffs to apply external service functions to the modular manufacturing process, the NDC will forgo potential savings in these two areas.

Design

While the NDC viewed the design of the modular units as an important element to the development of this project and to its acceptance to the community, the community viewed design as secondary to the type of ownership structure of the housing units. Community groups that have reviewed the plans of Erie/Ellington's future development have expressed to the NDC that this project should be used as an opportunity to create additional homeownership in this area and not straight rental housing as they had originally planned.

In the planning stages of this project, the NDC sought the services of the architect to ensure a high quality of design for the modular units. Although design was initially a high priority, the NDC has come to realize that this was not the greatest concern for the

community and that the final designs of the architect were not over and above the capacity of a modular manufacturer. Nonetheless, this cost saving, which at minimum is 3-6% of the project's total development cost, has been forgone.

Buttoning-Up Process

The ideal the way in which to efficiently proceed with the buttoning-up process is to have the manufacturer oversee this work. At the suggestion of the Department of Neighborhood Development (DND), the NDC is seeking to hire a construction manager to monitor this process to ensure that the quality of this work is to a high standard. In Boston's previous experience of developing modular housing, DND had to use additional funds to rectify problems with modular units which were caused by the poor quality of the buttoning-up work.

In contracting out the full-time service of a construction manager to monitor the buttoning-up process, the NDC will incur (at minimum) an additional \$30,000 to \$40,000 cost to this project. While the NDC may consider this front-end cost as a reasonable investment to preventing future problems as a result of poor buttoning-up work, it should understand that DND's cautions are based on an encounter with one inexperienced modular manufacturer that has since gone out of business. There are many modular manufacturers that have remained in business due in part to their proven track record and capacity to do good work.

Labor

The option to use modular building technology in developing affordable housing should not be pursued in isolation of other objectives that the NDC may have. In pursuing this method of development, the NDC will forsake the opportunity to create local employment opportunities in the process of constructing the housing units.¹⁹ The NDC will have to use exported labor to fulfill its objective of developing modular housing units. Essentially, this development option works in opposition to the NDC's economic development initiative which, in part, seeks to create local employment opportunities for local residents. In addition to using exported labor to construct the housing units, the NDC will not recognize a saving in the cost of labor.

Although one of the potential savings of modular housing is in its low cost of labor, as the workforce is comprised of low skilled non-unionized labors, the NDC will have to abide by the prevailing wage rule in its compensation to the factory workers. The NDC will use public funds in developing this project and are required to pay prevailing wages. The prevailing wage statute requires contractors on public projects to pay union and non-union workers alike the same wage rates and benefits.²⁰ Therefore, the NDC will pay the modular factory workers the equivalent wages as unionized laborers that develop conventional stick-built housing.

¹⁹ While the NDC can potentially create local jobs by ensuring that all on-site work including utility connections to the public lines, electrical, plumbing, and foundation work are completed by local labor, it is likely that the skilled laborers of these trades are unionized.

²⁰ Jim Miara, "Delayed Corporate Moves Keep Space at a Premium," Boston Business Journal, 3 March 1997 [journal on-line]; available from <http://www.amcity.com/boston/stories/030397/newscolumn2.html>; Internet.

In concluding my assessment of how the NDC has used the efficiencies of the modular production process, it is clear that the advantages of modular housing have not been fully utilized and therefore the NDC will not recognize the optimal savings that modular has to offer. If the option to use modular building technology requires that the NDC sacrifice the opportunity to create local jobs while not realizing up front savings, then the NDC might consider reevaluating its objectives in seeking to develop modular housing as it is not receiving the optimal savings in the development cost of this project.

LIST OF INTERVIEWEES

John Sharratt Associates	February 1998
Sister Margaret Leonard Project Hope	March 1998
Ann Houston Codman Square Neighborhood Development Corporation	March 1998
Bill Jones Former Executive Director Codman Square Neighborhood Development Corporation	April 1998
Mossiak Hacoban Executive Director Urban Edge	March 1998

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